National Aeronautics and Space Administration

Explore NOW Breakout Group on Capabilities & Technologies

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Breakout Group #2 – Day 2

What capabilities/technologies are needed for a human mission to a NEO?

Desired Outcome

- Identification of capability gaps that would preclude full achievement of objectives for a human NEO mission during the on-site portion of the mission
- Ranking in order of the necessity to be closed prior to mission start
- Technology development options that could close the top 5-10 capability gaps.

This information will be valuable input into technology planning for NASA and international partners. The discussion at the workshop will also stimulate further consideration of capabilities and technologies needed for a future human NEO mission.

Questions

- What currently unavailable capabilities are needed to safely and affordably achieve mission objectives during the on-site portion of a human NEO mission?
- Rank the capability gaps in terms of the necessity to close them prior to mission start.
- What technology development options could close the key gaps?

Capability Gaps

Area	Gaps
PROX OPS Proximity operations for surface & subsurface access	15
CHARACTERIZATION Target characterization & sample handling	32
ON OUR OWN Mission system autonomy & robustness	30
HUMAN SYSTEMS Life support and human health/performance	30
OTHER	1

- Important capability gaps in all areas
- Cross cutting area: Reliability, autonomy, smart systems

PROX OPS

#	Key Capability Gaps	Technology Development Options
44	EVA / robotics operations & anchoring	Jetpack, anchoring/tethering, suit lock, teleoperating robotics, space suit/robot info systems, MMSEV, free-flying lighting/ cameras," clean" suit, dust mitigation, EVA tools, local subsurface characterization
28	Situational awareness, station keeping & rendezvous	Control systems, position determination, lidar/radar/other, fuel-efficient prox ops propulsion, real-time trajectory control, plume impingement, information systems & modeling for terrain-relative nav

- Unknown environment
- Safety

CHARACTERIZATION

#	Key Capability Gaps	Technology Development Options
9	Sampling & prospecting	Drilling/coring, subsurface sample acquisition, anchoring, sensors for subsurface characterization, sample encapsulation, backward PP, preserving volatiles, intelligent sample selection, plume/ejecta collection
8	On board science	On board laboratory, miniature instruments, expert system, high-BW comm, clean containment

- Subsurface & interior structure (rubble pile to single rock)
- On site analysis

ON OUR OWN

#	Key Capability Gaps	Technology Development Options
48	System autonomy, automated planning & mission ops	Reconfigurable/adaptable systems, AI, diagnostics for repair, on board mission planning, just-in-time training
7	System reliability & repair	Functional redundancies, common components, fault detection/isolation/ recovery, robust ECLSS, spare part manufacturing on demand, self repair, design for sustainability, test programs for reliability

- Autonomy & reliability are key
- Logistics & sparing philosophy
- FDIR

HUMAN SYSTEMS

#	Key Capability Gaps	Technology Development Options
48	Radiation protection & warning	Detection & warning systems, prediction models, shielding, hab design, pharmaceutical countermeasures, personnel dosimetry, rad hard systems, shield vehicle with NEO
53	High reliability life support	Closure (air & water), miniaturization / low consumable footprint,

- A lot of work under HRP – please continue

Final Thoughts

- Any ddditional overarching points

Backup

Parking Lot

- Items for future consideration